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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/619,796	07/15/2003	Francis X. Canning	CANNING.001CP2	7886

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EXAMINER

DAY, HERNG DER

ART UNIT	PAPER NUMBER
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2128

NOTIFICATION DATE	DELIVERY MODE
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10/08/2008

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary

Application No.

10/619,796

Applicant(s)

CANNING, FRANCIS X.

Examiner

HERNG-DER DAY

Art Unit

2128

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period **will** apply and **will** expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply **will**, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 September 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-39 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 9/18/08.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date: _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

1. This communication is in response to Applicant's RCE and Amendments and Response ("Amendment") to Office Action dated June 20, 2008, filed September 18, 2008.

1-1. Claims 2, 22, and 23 have been amended. Claims 2-39 are pending.

1-2. Claims 2-39 have been examined and rejected.

Information Disclosure Statement

2. The information disclosure statement filed September 18, 2008, fails to comply with 37 CFR 1.98(a)(1), which requires the following: (1) a list of all patents, publications, applications, or other information submitted for consideration by the Office; (2) U.S. patents and U.S. patent application publications listed in a section separately from citations of other documents; (3) the application number of the application in which the information disclosure statement is being submitted on each page of the list; (4) a column that provides a blank space next to each document to be considered, for the examiner's initials; and (5) a heading that clearly indicates that the list is an information disclosure statement. The Cited documents No. 1-4 fail to comply with 37 CFR 1.98(a)(1), are not prior art, and the prosecution on the merits of each related application is not closed. Therefore, it has been placed in the application file, but the information referred to therein has not been considered as to the merits.

Furthermore, the listing of references in an information disclosure statement *letter* is not a proper information disclosure statement submission. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP

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§ 609.04(a) states, “the list ... must be submitted in a separate paper.” Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 2-8, 15-16, and 25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4-1. Claim 2 recites the limitation “using said computer processor, producing a decomposition of said interaction matrix by performing matrix operations on said first sub-blocks wherein;” in lines 11-14 of the claim. It is indefinite because it appears that the above-recited limitation is incomplete.

4-2. Claims not specifically rejected above are rejected as being dependent on a rejected claim.

Claim Rejections - 35 USC § 101

5. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

6. Claims 2-39 are rejected under 35 U.S.C. 101 because the inventions as disclosed in claims are directed to non-statutory subject matter.

6-1. Claims 2-39 are directed to the manipulation of abstract ideas of data compression or factorization of an interaction matrix by applying a decomposition. This claimed subject matter lacks a practical application of a judicial exception (law of nature, abstract idea, naturally occurring article/phenomenon) since it fails to produce a useful, concrete, and tangible result.

As stated in the MPEP 2106 (IV)(C), “Likewise, a claim that can be read so broadly as to include statutory and nonstatutory subject matter must be amended to limit the claim to a practical application. In other words, if the specification discloses a practical application of a section 101 judicial exception, but the claim is broader than the disclosure such that it does not require a practical application, then the claim must be rejected.”, “The tangible requirement does not necessarily mean that a claim must either be tied to a particular machine or apparatus or must operate to change articles or materials to a different state or thing. However, the tangible requirement does require that the claim must recite more than a 35 U.S.C. 101 judicial exception, in that the process claim must set forth a practical application of that judicial exception to produce a real-world result. *Benson*, 409 U.S. at 71-72, 175 USPQ at 676-77 (invention ineligible because had “no substantial practical application.”).” and “Thus, a claim that recites a computer that solely calculates a mathematical formula (see *Benson*) or a computer disk that solely stores a mathematical formula is not directed to the type of subject matter eligible for patent protection.” Also, as stated in the MPEP 2106.02, “If the “acts” of a claimed process manipulate only numbers, abstract concepts or ideas, or signals representing any of the foregoing, the acts are not being applied to appropriate subject matter. *Gottschalk v. Benson*, 409 U.S. 63, 71 - 72, 175 USPQ 673, 676 (1972). Thus, a process consisting solely of mathematical operations, i.e., converting one set of numbers into another set of numbers, does not manipulate appropriate subject matter and thus cannot constitute a statutory process.”

Specifically, as described in the specification in lines 19-20 of page 8, "The terms "sources" and "physical sources" are used herein to include all types of actual and/or fictitious sources." Therefore, the claimed subject matter is directed to the manipulation of abstract ideas including those fictitious sources (e.g., a number, formula, expression, etc.) and/or the effect of those fictitious sources. In other words, the claimed subject matter is so broad such that it does not provide or require a practical application. On the other hand, the claimed subject matter is seeking to patent substantially every application of the idea of factorization of an interaction matrix by applying a decomposition.

Furthermore, the claimed subject matter does not produce a tangible result because the claimed subject matter fails to produce a result that is limited to having real world value rather than a result that may be interpreted to be abstract in nature as, for example, a thought, a computation, or manipulated data. More specifically, the claimed subject matter includes producing, computing, and/or applying a decomposition. This produced result remains in the abstract and, thus, fails to achieve the required status of having real world value. In other words, the claimed subject matter is consisting solely of mathematical operations, i.e., converting one set of numbers into another set of numbers, representing sources (including fictitious sources) and/or the effect of those sources and thus nonstatutory because the manipulation on abstractions just can not produce a tangible result.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 2-4, 6-8, and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Canning et al., Rockwell Inst. Sci. Center, "Fast Direct Solution of Standard Moment-Method Matrices", IEEE Antennas and Propagation Magazine, June 1998, pages 15-26, (IDS 17, filed October 14, 2003), hereinafter referred to as "Rockwell", in view of Ubale et al., U.S. Patent 6,363,338 issued March 26, 2002.

8-1. Regarding claim 2, Rockwell discloses a method for factorization of an interaction matrix describing physical effects due to electric charges (matrices produced by standard Moment Method computer programs, page 25, right column, paragraph 2, lines 1-2), comprising:

identifying one or more first sub-blocks in said interaction matrix, said first sub-blocks containing non-zero elements (for example, Block 1 in Figure 5);

identifying one or more second sub-blocks in said interaction matrix, said second sub-blocks containing all zero elements (for example, elements out of Blocks in Figure 5);

using said computer processor, producing a decomposition of said interaction matrix by performing matrix operations on said first sub-blocks (to do an LU factorization of Z in a way that preserves its sparse form, page 20, right column, paragraph 2; page 21, section 7.2, Features of the sparse LU calculation) wherein;

said decomposition contains a plurality of sub-blocks containing all zero elements (Lower triangular is defined to mean that the non-zero elements occur only on or below the diagonal, and upper triangular is defined analogously, page 21, left column, paragraph 1); and

storing said decomposition on a computing system, wherein storing said decomposition requires less storage than storing said interaction matrix (For the sparse factored matrices L and U, the storage would scale as $\log(N)N^{1.5}$. This is still very sparse compared to the full matrix, page 24, left column, paragraph 3).

Rockwell fails to expressly disclose “to identify one or more small-valued elements of an interaction matrix” and “setting said one or more small-valued elements to zero”.

Ubale et al. disclose a theoretical framework for deriving an optimum bit allocation and simplified processes derived from the theoretical framework. Specifically, Ubale et al. disclose in column 21, lines 6-11, “One variation attains a significant reduction in computational complexity by recognizing that a few elements in a typical spreading matrix array W are significantly larger than all other elements, and that good performance can be realized even when many of these smaller elements are set to zero.”

It would have been obvious to one of ordinary skill in the relevant art at the time the invention was made to modify the teachings of Rockwell to incorporate the teachings of Ubale et al. because set smaller elements in a matrix to zero may attain a significant reduction in computational complexity.

8-2. Regarding claim 3, Rockwell further discloses wherein said decomposition comprises an LU decomposition (the sparse LU solver, pages 20-21, section 7.1).

8-3. Regarding claim 4, Rockwell further discloses wherein said decomposition comprises matrix inversion (each block of D be inverted, page 20, left column, paragraph 2).

8-4. Regarding claim 6, Rockwell further discloses wherein at least one of said matrix operations is performed using optimized software (using pivoting to stabilize the LU decomposition, page 23, right column, paragraph 4).

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8-5. Regarding claim 7, Rockwell further discloses wherein either decompositions of first sub-blocks for a first block row below the main diagonal of said interaction matrix are substantially computed before decompositions on a second block row or a substantial number of decompositions of first sub-blocks for a first block column to the right of the main diagonal of said interaction matrix are substantially computed before decompositions on a second block column (the representation of block one of Z can be changed one column at a time, page 21, right column, the last paragraph).

8-6. Regarding claim 8, Rockwell further discloses wherein said factorization permits direct solution of a system of linear equations and wherein said direct solution comprises the division by a pivot (using pivoting to stabilize the LU decomposition, page 23, right column, paragraph 4).

8-7. Regarding claim 15, Rockwell further discloses comprising: generating said interaction matrix from a first matrix, wherein said interaction matrix is relatively more sparse than said first matrix, and wherein the generation of said interaction matrix uses numerical interaction data (the matrix Z is replaced by a sparse representation of Z, page 16, left column, paragraph 4).

8-8. Regarding claim 16, Rockwell further discloses wherein said using said interaction matrix comprises reducing a rank (the SVD of A, page 16, left column, the last paragraph).

9. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Canning et al., Rockwell Inst. Sci. Center, "Fast Direct Solution of Standard Moment-Method Matrices", IEEE Antennas and Propagation Magazine, June 1998, pages 15-26, (IDS 17, filed October 14, 2003, hereinafter referred to as Rockwell), in view of Applicant's assertion.

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9-1. Regarding claim 5, Rockwell discloses a method for factorization of an interaction matrix in claim 2. Rockwell fails to expressly disclose wherein said decomposition comprises an LDM decomposition.

Applicant discloses in the last paragraph of page 39, “Other variations will be evident to those experienced in this field. For example, it is possible to use an LDM decomposition rather than an LU decomposition.” In other words, Applicant asserts using an LDM decomposition rather than an LU decomposition is evident to those experienced in this field.

It would have been obvious to one of ordinary skill in the relevant art at the time the invention was made to modify the teachings of Rockwell to incorporate Applicant’s assertion because using an LDM decomposition rather than an LU decomposition is evident to those experienced in this field.

Applicant’s Arguments

10. Applicant argues the following:

10-1. Response to Rejection of Claims 2-8, 15-16, and 25 Under 35 U.S.C. 112 First Paragraph

(1) “Applicant has amended Claim 2 to remove this reference while retaining a statement regarding a plurality of blocks of zero elements in the decomposition.” (page 9, paragraph 3, Amendment)

10-2. Response to Rejection of Claims 22 and 33-36 Under 35 U.S.C. 112 Second Paragraph

(2) “Applicant has amended Claim 22 to clarify this relationship.” (page 10, paragraph 1, Amendment)

10-3. Response to Rejection of Claims 23, 24 and 37-39 Under 35 U.S.C. 112 Second Paragraph

(3) “Applicant has changed Claim 23 to recite "program" in place of "computer program.”” (page 11, paragraph 1, Amendment)

10-4. Response to Rejection of Claims 2-39 Under 35 U.S.C. 101

(4) “Applicant has amended Claim 2 to clarify that the tangible result is the use of less storage. Computer storage is an exhaustible, physical, resource. The claimed invention reduces usage of this physical resource and thus produces a tangible result.” (page 11, paragraph 3, Amendment)

Response to Arguments

11. Applicant’s arguments have been fully considered.

11-1. Applicant’s argument (1) is persuasive. The rejections of claims 2-8, 15-16, and 25 under 35 U.S.C. 112, first paragraph, in Office Action dated June 20, 2008, have been withdrawn.

11-2. Applicant’s argument (2) and (3) are persuasive. The rejections of claims 22-24 and 33-39 under 35 U.S.C. 112, second paragraph, in Office Action dated June 20, 2008, have been withdrawn.

11-3. Applicant’s argument (4) is not persuasive. The newly added limitation, “wherein storing said decomposition requires less storage than storing said interaction matrix” appears to simply express the intended result without limiting a claim to a particular structure. In other words, the newly added wherein clause in a method claim may not be given any weight. Therefore, claim 2 as a whole still lacks a practical application of a judicial exception (abstract idea) since it fails to produce a useful, concrete, and tangible result and the argument is not persuasive.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Herng-der Day whose telephone number is (571) 272-3777. The Examiner can normally be reached on 9:00 - 17:30.

Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2100 Group receptionist: (571) 272-2100.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Kamini S. Shah can be reached on (571) 272-2279. The fax phone numbers for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Kamini Shah/

Supervisory Patent Examiner, Art Unit 2128

/Herng-der Day/
Examiner, Art Unit 2128

September 30, 2008